

Seeing with the customer's eye: exploring the challenges and opportunities of AR advertising

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***Seeing with the Customer's Eye:
Exploring the challenges and opportunities of AR Advertising***

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Abstract

This position paper on Augmented Reality (AR) advertising offers a conceptual framework of recent scholarship on the intersection between AR technologies, advertising and marketing metrics. The framework identifies theory-based building blocks for this domain alongside relevant recent examples. It proposes a conceptual case for contextualisation of advertising content through AR technology. Following the theory-building blocks, an agenda for future research in AR advertising is specified, incorporating multiple conceptual perspectives and empirical directions.

Key words: Augmented Reality, contextualisation, spatial presence, real-time analytics, advertising

Advertisers have been aware of the contextual nature of human experience at least since the early work of Kahneman and Tversky (1982). Yet, *contextualisation* of advertising, the ability to tailor content in-real time based on the customer's physical surroundings, has thus far eluded practical applications (Mehra 2012). Partly because of technological constraints, advertisers have not tailored *mass* marketing communications to individual customers' physical surroundings. This potentially overlooks an important aspect of customers' brand engagement, which is oftentimes based on the processing of contextual information (Kumar and Gupta 2016; Wang 2007). With the emergence of the Augmented Reality (AR), however, which with the aid of mobile computing technology embeds digital content in the customer's view of the physical environment, contextualisation of advertising becomes a natural extension of the technology. Although it has not been discussed at length in the marketing literature, real-time adaptation of content to an individual customer's physical surroundings is at the core of AR advertising; and it represents an important direction for future research. The aim of this positioning article is to draw attention to broad conceptual 'building blocks' that frame AR as a key technology for engaging customers through contextual advertising experiences.

Despite a paucity of formal research, companies increasingly are turning to AR as a tool in their advertising strategy; in doing so, they aim to offer a higher degree of engagement with their brand communications (Adweek 2018). AR is unique among media channels because it embeds digital or holographic content (e.g., product or service visuals, animations, information or instructions) within a customer's experience of the physical environment, interactively and in real-time (Azuma et al. 2001). This not only enables customers to get a better feel for promoted products (e.g., by virtually trying on Michael Kors' new sunglasses collection through an AR banner ad); it also opens new opportunities for engagement with the advertised brands (Scholz and Smith 2016).

For instance, the fast food chain Burger King, which has promoted flame-grilling as their signature cooking method since the 1950s, has recently introduced the "Burn That Ad" AR feature in its mobile app. Customers who use the feature are invited to point their smartphones at a competitor's print or billboard advertisement, and virtually set these aflame. After competitor ads have been burned, a mobile coupon appears that can be exchanged for a free Whopper at one of the newly designed express windows at Burger King's nearest restaurant. This unique AR campaign connects a customer's physical environment (e.g., a print ad viewed at home, or a billboard seen on the street) with engagement with the Burger King brand.

In addition to enabling customers to engage with products, services or brands, AR is increasingly heralded as a strategy to add value and improve incremental sales (Boston Consulting Group 2018). For instance, Converse uses its Sampler app to stimulate purchases of the latest designer sneakers from their online catalogue. By pointing a smartphone towards their feet, customers can see how the (virtual) shoes look when worn (Hilken et al. 2017; 2018). Virtually trying on the shoes contextualises the brand in an experiential way by relating it to the customer's physical body and the perception of the physical surroundings. Subsequently, customers have the option to buy the pair of sneakers using a 'buy now' function within the AR application. Contextual brand experiences potentially improve the link between advertising and sales because they 'fill-in' missing information, especially when a customer finds it difficult to generate mental imagery between the context in which he or she processes advertising information and the actual product-use context (Heller et al. 2019a). For example, with the Amazon AR app, customers can experience advertised products (e.g., a vase or other home decorations) in context, by placing 3D holograms of the products in their physical surroundings (e.g., the vase on a shelf or a picture on a living room wall). Heller et al. (2019a) have shown that such AR-enabled product communications reduce the mental

effort required to generate purchase related imagery. Without AR, customers thus might experience difficulty imagining a product in a distant context. This is common when a customer brings a product home only to discover it looks different to how she imagined it at the store. With AR, however, customers offload the mental imagery to the technology, and this improves decision comfort as well as intentions to buy the product (Heller et al. 2019a).

Despite these novel and reportedly effective examples, as well as optimistic revenue projections based on click-through-rates on banner ads (Adweek 2018), recent market surveys reveal that a large majority of customers are still uncertain about the value of AR. The use of AR is not mainstream despite significant investments in the technology (ARtillery Intelligence 2019). Many customers who have used AR also report that the applications do not live up to the hype (DigitalBridge 2017). This reveals a problem with two important advertising metrics: customer adoption and word-of-mouth (WOM). In our view, these problems may arise partly because of a nascent state of the AR devices, and partly because advertisers have not fully realized contextual AR advertising. Similarly, many managers report being sceptical of AR's value potential (Boston Consulting Group 2018); they have difficulty differentiating AR from established media channels or related technologies like Virtual Reality (VR)¹, in part, because they overlook the core aspect of AR advertising, namely the contextualisation of content. This presents managers with the daunting challenge of investing in a technology whose value drivers they do not fully understand. Equally, customers through lack of understanding and exposure may only marginally value and perhaps not even utilize the technology. Hence, there is a pertinent managerial need for greater understanding of how customers can engage with AR advertising, and how AR

¹ Unlike AR, Virtual Reality (VR) transports a customer's perception into a fully digital environment devoid of real-time interaction with the physical context. Consequently, VR is distinguished because it does not provide contextualisation; content in VR is independent of the customer's physical surroundings.

advertising can drive key marketing metrics such as customer engagement, positive intent, acceptance and diffusion of advertising information through WOM.

Beyond this clear managerial rationale, there is also a compelling need to widen the scholarly knowledge base on how AR enables contextual advertising, and how such advertising can enhance customer engagement. As guidance from theorizing has remained relatively scant, we need to know whether the potential for contextual AR advertising is ‘for real’; or just another hype cycle. Therefore, in this article we propose a positioning framework to represent contextualisation of advertising content based on AR technologies, which offers a more in-depth understanding of how the design and deployment of AR translates into contextual engagement for customers, and how AR engagement can encourage customers to share their experience with others.

We seek to extend current advertising literature from three different angles. Firstly, we summarize current research on the use of AR in advertising and synthesize existing findings to identify substantive and theoretical building blocks for AR advertising. Secondly, we develop a framework of how these theoretical building blocks give rise to a staged process of contextualisation in AR advertising. Thirdly, with the aim of moving the field forward, we outline a research agenda that identifies prominent opportunities for future scholarly investigations that extend theoretical perspectives within the contextualisation paradigm.

Contextualisation of AR Advertising

The effectiveness of advertising depends in many respects on the context in which a customer experiences advertising content. A creative execution may be effective (or not) depending on small variations in the customer’s immediate environment like a viewing angle when watching TV, whether a customer is walking or talking with a friend, listening to a radio in

the background, or cooking dinner. Following Scholz and Smith (2016), who interpret AR as a marketing tool, we suggest that AR contextualisation is a marketing activity in application, and a design feature for the development of AR advertising (Zhao and Balagué 2015). Its aim is to generate digital affordances that influence customer behaviour in physical environments. Even now, many AR applications overlook this potential. Typical AR advertisements' feature add-ons like Taco Bell's Facebook feed that pops up in AR mode when a customer points their mobile phone at a box of Doritos; or gimmicks like Starbuck's Valentine's Day promotion that overlays AR images of flying hearts over a coffee cup. Unlike these gimmicks, where interest is derived primarily based on novelty (Hilken et al. 2017), AR advertising fundamentally allows the advertiser to interact with the customer's physical surroundings. This distinguishes AR from related media like Virtual Reality (VR) or online advertisements, which tailor content to digital environments. Accordingly, AR advertising is conceptually different to online, and traditional media channels like TV, print, or radio (Hilken et al. 2018). Moreover, it distinguishes itself from the well-known notion of personalisation (i.e., trying to match messages with individual customer's needs, preferences and attitudes; Aguirre et al. 2015), because AR contextualisation engages what psychologists call 'bottom-up' behaviour control processes where cues in the environment initiate and sustain customer behaviour (Schwarz 2006), in contrast to a 'top-down' control process through pre-formed attitudes.

Recent theorizing in marketing about AR has emphasized the notion of situated cognition that describes such bottom-up behaviour processes (Hilken et al. 2017). Situated cognition theorizing implies that behaviour is inseparable from the environment and from its so-called affordances (i.e., perceived possibilities for action) that predispose the customer to interpret information within a specific context (Wilson 2002). In a seminal work, Hilken et al. (2017) argued that "customer's information processing is embedded in their physical

environment and embodied through physical simulations and actions” [p. 885]. Situating advertising information by embedding and embodying it through AR creates experiences of *spatial presence*, through which the customer considers AR content part of their physical surroundings. Spatial presence benefits the customer by helping make more accurate judgments about products, and these judgments reflect in improved marketing metrics like engagement, psychological ownership, purchase intentions, or WOM (Carrozzi et al. 2019; Heller et al. 2019a; Hilken et al. 2020).

However, to date researchers have not discussed at length the relevant implications of *the way* in which AR technology embeds and embodies digital content. A key implication is that AR maps the customer’s physical environment. To embed digital content relative to physical objects in the customer’s environment, AR scans and locates those objects in the physical space. For example, to place an AR hologram of a vase on a shelf, AR recognises the position of the shelf as a physical object in the customer’s view of their surroundings and adjusts the display of the AR hologram to fit that space. In effect, through such contextual mapping AR “sees with the customer’s eye”, adjusting in real-time the display of the AR holograms to the customer’s perspective. We contend that this has significant implications for the contextualisation of AR advertising.

Dynamically mapping each customer’s physical surroundings puts AR in a distinct category of advertising media. Current AR applications natively tailor AR display based on the customer’s immediate physical environment, adjusting to lighting conditions (e.g., adjusting the brightness of the AR hologram in sunny or shaded surroundings), depth perception (by varying the size of an AR hologram), or perspective (depending if a customer is standing or sitting while viewing a hologram). So far, however, AR advertising has not leveraged this ability to tailor information to brand content. In other words, advertisers have not yet utilized the ability to tailor AR displays as an active approach for driving key

marketing metrics. We contend this is partly because advertisers have not fully conceptualized the idea of contextualisation of advertising in AR and have not explored the potential of AR's context mapping functions to make this a reality. AR contextualisation requires that brand information adjust depending on the customer's perspective of their physical surroundings. Whether a customer is walking, talking with a friend, listening to a radio in the background, or cooking dinner, AR, in principle, can adjust brand content to fit these variations in a customer's immediate environment.

Researchers have argued that situated cognition, which underlies AR's influence on customer behaviour, is a natural and in many respects preferred mode of information processing (Semin and Smith 2013), potentially making contextual AR advertising highly engaging. Yet, little is known about contextual customer engagement, and how it can be achieved through AR advertising. In general, Kumar and Gupta (2016) state that the focus in advertising has shifted from an emphasis on sales, to that of customer engagement based on a goal of developing sustainable relationships with a customer-base. While traditional advertising has been mainly about a one-directional depiction of products and services, a renewed focus on engagement is increasingly employing digital technologies in physical settings to improve interactivity of advertising activities.

Because AR enables customers to engage with digital products or services in their physical environment in an intuitive and seamless manner, it makes the contextual engagement feel "real" based on a sense of spatial presence (Hilken et al. 2017). That is, in AR it appears as though the customer is really trying on a new pair of Converse sneakers or burning down Burger King's competitors. Such an enhanced form of engagement, in turn, triggers a process in which the experience of spatial presence is translated into marketing metrics that reflect valued outcomes, positive intent, and WOM (Marinova et al. 2017). In the following section we propose a process of AR contextualisation involving three main

building blocks that distinguish contextual AR advertising from other media. Together these blocks describe contextualisation according to the flow of information between: (1) context mapping; (2) content matching; and (3) customer experience of spatial presence. We also suggest that these building blocks link with standard marketing metrics that advertisers may apply across various media channels to track effectiveness of contextual AR advertising against other media.

Conceptual Building Blocks for Contextualisation of AR Advertising

Context Mapping. A critical part of AR advertising relies on the customer, who uses a device such as a smartphone to scan his or her physical environment with a camera that builds a detailed map of that environment. This functionality sets AR apart from other advertising media, allowing it to locate physical objects in the customer's physical space as well as compute the customer's perspective towards these objects.

Image Classification. As technology develops, computer vision can further classify physical objects to identify and interpret what they are (Restrepo-Rodríguez et al. 2019). Accordingly, by 'seeing with the customer's eye', AR's real-time context mapping functionality informs an advertiser that, for example, there is a shelf at a specific location in the customer's living room. This is done by incorporating aspects of machine learning with the image data scanned by an AR device. Such information allows, for example, the IKEA Place app to recommend matching furniture items to those it recognises in a customer's room, and subsequently place them into the view of the physical environment as lifelike 3D holograms (ChargedRetail 2019).

Gaze tracking. Tracking a customer's gaze, an advertiser also knows that the customer is currently looking at the shelf in his or her living room. Since this information is required to provide realistic representation of AR holograms that seamlessly blend with the

customer's perception of physical objects, AR devices may track customer's eye movements and record fixations using back facing cameras (van der Meulen, Kun, and Shaer 2017). This information helps an advertiser to estimate a customer's perspective towards objects in the physical environment, and to determine not only what the customer is looking at currently, but also analyse a pattern of gaze fixations. As such, marketers can use gaze tracking, to gain additional insights and target customers with interactive holograms that 'come alive' when gazed at. For example, Microsoft's HoloLens 2 provides an interactive hologram of a desk lamp that turns on when a customer gazes at the hologram (van der Meulen et al. 2017).

Real-time Analytics. Performing real-time analytics on the previously mentioned information gathered by AR determines more than location of objects in the customer's physical environment. It allows an advertiser to learn about the motivational significance of objects, for example through correlates of gaze fixations (Binetti et al. 2019). Consequently, applying real-time analytics in AR, advertisers can become aware of how the customer interacts with holograms in a physical context. This, in turn, allows an advertiser to learn that a customer has placed an AR hologram of a vase on the shelf in her living room next to a white clock he or she really likes, for example. Currently, real-time analytics that measure distances between AR holograms and real objects, gaze durations, and gaze movements allow an advertiser to predict customer interactions between holographic and physical objects (Porter and Heppelmann 2017).

Affordance Recognition. As the technology develops further, computer vision will eventually integrate aspects of image classification, gaze tracking, and real-time analytics to estimate the relevance and purpose of objects in the customer's physical environment. In situated cognition theory terminology, the behavioural relevance of objects in an environment represents their affordances (Stark et al. 2008). Accordingly, we propose that context mapping culminates in what we call 'affordance recognition' by AR. That is, AR is able to

not only map the location and type of objects in the customer's living room, but also offers the possibility of learning the importance and functionality of and even the level of emotional attachment that consumers place on objects, which gives an advertiser an unprecedented access into customers' lives. In this way, context mapping opens a new frontier of contextualised AR advertising, in which content is aligned based on detailed information about the customer's physical environment in real-time and at scale.

Content Matching. Since AR enables advertisers to embed visual, 3D advertising content into the physical environment such that it that forms an integral part of the customer's first-person experience, content matching refers to a real-time adaptation of advertising messages with a customer's physical surroundings. Matching is done through utilizing information from the earlier stage of context mapping to drive the contextualisation of AR advertising.

Embedding. A primary requirement of content matching is the customer's suspension of disbelief that a digital depiction of a vase, for example, represents a real object within a living room (Hilken et al. 2017). Accordingly, we propose that suspension of disbelief in AR relies on an authentic visual integration, which is a customer's experience of embedding of digital content into the physical environment. When viewing such embedded digital content, customers are critically sensitive to an advertisement's ability to depict a visually appealing integration between the digital content and the physical environment. Thus, *visual appeal* is a higher-order element for content matching and is related to customers' experience of the aesthetics (Huang and Liao 2015), richness (Javornik 2016a,b) and vividness (Yim, Chu, and Sauer 2017) of projected content. It helps customers to get a better feel for the colour and texture of a virtual vase for example and, more importantly, believe that it is real. This is corroborated by Huang and Liao (2015) and Lee, Chung, and Jung (2015), who report that the visual appeal of AR-enabled objects in advertising is an important factor in triggering

positive perceptions and, subsequently, willingness to engage with AR advertising. For example, early AR applications that projected holograms of furniture into a customer's context often lacked visual appeal. Therefore customers would stop interacting with the application, as the holographic representations did not promote the customer's belief of being realistic within their physical environment (Yu et al. 2010). We propose that the appeal of visual integration is based on matching the visual components with information gathered during the context mapping stage. In this way, AR content is matched dynamically and in real-time by advertisers to achieve contextualisation.

Creative execution. Content matching, however, extends beyond visual integration because it enables more creative execution of advertisements, which also drives the overall *visual appeal* of AR advertising. While integrating digital content with the customer's perception of physical surroundings reflects the notion of embedding noted by recent studies (Hilken et al. 2017), creative execution adds an active design process to embedding that explores the role of deep contextual relationships between AR content and the customer's environment. For example, automatically altering the colour of the AR vase to match the white clock on the customer's shelf is a form of creative execution in AR. Similarly, recommending additional products by placing a matching AR lamp or a chair next to an IKEA AR sofa creates value through product relationships that drive contextual visual appeal. This becomes relevant for products where visual appeal crucially depends on other objects in the customer's surroundings (Heller et al. 2019a). In this way creative execution promotes an overall look, instead of displaying a separate object. AR applications like L'Oréal's makeup sampler make use of this principle by allowing customers to virtually apply lipstick, eye shadow and a mix of makeup products to see how they all fit together creating an overall look before purchase.

Information fit-to-task. In addition to visual appeal, content matching to information gathered during the context mapping stage in AR addresses the large body of research (Gupta, Yadav, and Varadarajan 2009; Kim and Stoel 2004) that describes how human judgments rely on complex relationships of reference points (Dholakia and Simonson 2005) and contrast effects (Kahneman and Tversky 1982) between a focal task and contextual information. It has been argued that the importance of advertising content can be based on its fit with a decision-maker's contextual information needs (Kim and Stoel 2004). For example, for customers concerned with healthy food options, KabaQ's AR application's depiction of dessert options in a restaurant menu will not only be visually appealing, but also renders an impression of portion size and information on ingredients and calories. However, the relevance of such information varies depending on what other diners have ordered, for example if a customer is dining with friends rather than alone. Matching content in real-time to customer's contextual tasks enhances the effectiveness of AR advertising. For instance, Baeck, Yoo, and Yoon (2018) find that customers experience a stronger connection with the brand when they are able to view themselves in a virtual AR mirror and project sunglasses on an image of their own face (as opposed to viewing them on professional models). That is, customers engage differently with brand content depending on a reference point of comparison, and they assess the properties of products and services differently following information contrasts available in a specific decision situation.

We propose that content matching provides a distinct perspective on aspects of visual appeal (through embedding and creative execution) and information fit to task in the context of AR because it is driven by real-time mapping of the customer's physical environment using AR applications. Consequently, content matching in AR represents an extension of advertising to information about a customer's perception of their physical environment.

Customer Experience. Content matching that follows the real-time mapping of the customer's physical context leads to a unique experience of contextualisation. Recent studies by Hilken et al. (2017; 2018) demonstrate that customer's perceptions of authentic and engaging contextual experiences in AR are commonly manifested in a sense of spatial presence. Spatial presence is based on a feeling of "non-mediation" (Lombard and Ditton 1997), such that customers fail to acknowledge the role of technology in an experience (Wirth et al. 2007). In consequence, customers suspend their disbelief and become convinced that they are interacting with a 'real' object that belongs in the context of their physical surroundings (Hilken et al. 2017; Schubert 2009). That is, customers feel that the advertised pair of sneakers projected on their feet or the yelp review projected onto a restaurant location is real, present, and relevant for them. Previous research has mainly considered presence, particularly a sense of "telepresence" (Draper, Kaber, and Usher 1998), in terms of a customer's immersion into a fully artificial digital environment (Witmer and Singer 1998), for example in the context of online shopping (Martínez-Navarro et al. 2019). However, an accurate understanding of spatial presence in an AR context demands a distinct conceptualization, which thus far has only received limited research attention. Specifically, and drawing on initial works (Hilken et al. 2017), we consider the key difference between notions of presence in digital environments and the experience of AR objects in physical environments is a sense of AR objects "being here (in the physical environment)" in contrast to feelings of "being there (in the virtual environment)".

In relation to contextualisation, spatial presence represents a customer's perception of an authentic context mapping and subsequent content matching by an advertiser. Previous research has mainly emphasized interactivity and vividness as generic advertising characteristics that lead to feelings of presence (Fiore, Kim, and Lee 2005; Fortin and Dholakia 2005), but we emphasize that in AR contexts, the unique content matching features

of visual appeal (from embedding and creative execution) and information-fit to task offer a more conceptually nuanced and managerially relevant view of the drivers of spatial presence. Support for this conjecturing comes from presence research, which emphasizes that a sense of presence can only arise when digital content is relevant and meaningful to a user's perception and actions in the physical world (Carassa, Morganti, and Tirassa 2005). Furthermore, focused attention towards digital content, enhanced through heightened interest and involvement are considered crucial antecedents to sustain customer acceptance of digital content as real within their physical surroundings (Wirth et al. 2007). Against this backdrop, embedding and creative execution, which enable visual appeal, when integrated with information-fit to task uniquely and in contrast to more generic advertising characteristics (e.g., interactivity or vividness), help achieve an AR relevance that is crucial to a sense of spatial presence. In turn, spatial presence offers a possible metric to judge how a customer reacts to advertisers' attempts at contextualisation in AR. While advertising in traditional media typically measures attention to a focal object, for instance the time spent viewing a YouTube advertisement, we propose that in AR advertising a customer's attention focus is better represented by the experience of spatial presence which accounts for a relation of the focal object with the customer's physical environment (Hilken et al. 2017).

It has long been recognized that customers embrace new technologies based on the expectation of the value that they will be able to derive from it (Marinova et al. 2017). Feng and Mueller (2019) argue that from a customer perspective there are many benefits associated with AR technology. Entertainment, way-finding, trying on products and moving objects around are some of the benefits that have emerged and lead Mangiaforte (2014) to conclude that, as a result of these, the level of customer engagement with AR campaigns is far higher than with more traditional (radio and TV) advertising. The feeling of spatial presence has been shown to have a positive impact on the strength of customer beliefs about product

attributes and attitudes toward advertised offerings (Fortin and Dholakia 2005). Similarly, Fiore et al. (2005) report a significant and positive effect of presence on a range of customer value expectations. This is corroborated across a variety of AR applications by Hilken et al. (2017), who demonstrate that spatial presence in AR has a positive impact on hedonic and utilitarian value perceptions. Consequently, a customer's experience of spatial presence provides an important metric not only to judge perceived levels of contextualisation, but also to depict a link between marketing outcomes and customer's experience of contextual AR advertising.

Linking AR with Marketing Metrics. Advertisers must be able to evaluate the effectiveness of AR advertising in relation to other media. This means linking AR advertising with existing metrics that apply across media channels. For instance, Baeck et al. (2018) demonstrate a positive influence of the use of an AR-based try-on app on customer purchase intentions, which is a common metric. Furthermore, the success of AR advertising relative to other media channels can be amplified by the extent to which customers are willing to share their experiences and recommend these to others; hence WOM becomes relevant (Heller et al. 2019a). For example, PepsiCo recently introduced the 'Unbelievable' campaign, which featured an AR-enhanced bus shelter in London, this led to a great deal of positive buzz across various social media. A YouTube clip explaining the campaign attracted 2 million views and 24,000 shares in just 7 days. This implies that common marketing metrics should be tracked between media channels to understand whether the unique building blocks that distinguish AR advertising also improve the effectiveness of advertising.

Privacy Constraints. Contextual AR advertising heralds a potential boon for marketers and customers alike, which can lead to improved marketing metrics. However, the process of contextualisation also poses a potential drawback. The same technology that enables contextualisation invariably infringes customer's privacy. This can be problematic,

especially in the traditionally private settings such as the customer's living room. Many customers who are aware their online behaviour can be tracked by advertisers seeking to use personal information to improve online content (Kumar and Reinartz 2018), may be equally concerned about contextualisation through AR. Context mapping gathers information about the customer's intimate physical surroundings. Accordingly, contextualisation of AR advertising extends the notions of the privacy paradox (Aguirre et al. 2015; Rauschnabel, He, and Ro 2018) to physical settings. On the one hand, sharing private information improves an advertiser's ability to match content based on the customer's physical environment, which leads to improved services that benefit the customer. On the other hand, a seamless experience of spatial presence sends a signal that the advertiser potentially has access to private information about the customer's physical environment. A concern for privacy protection interferes with contextual AR advertising in two important ways. Firstly, it restricts access to information about private spaces limiting the advertiser's ability to achieve content matching. Secondly, it moderates the link between the experience of spatial presence and marketing metrics. Since for a strongly privacy-concerned customer the experience of spatial presence implies that their privacy is being infringed, these customers may be less (rather than more) likely to respond positively to experiences of spatial presence.

Privacy in AR contexts is poorly understood in the current literature. We propose, however, that privacy poses a critical constraint on AR contextualisation, and it necessitates explicit consideration within the paradigm of AR advertising contextualisation. Illustratively, the early failure of Google Glass could in part be attributed to customers' privacy concerns. Since Google Glass not only recorded contextual information belonging to its user, but also captured information about anyone in the user's field of view, Google Glass became socially unacceptable (Haque 2015). To avoid similar fate, AR contextualisation requires strong

privacy protection, anonymisation of data, demarcation of public versus private spaces, and social norms that can drive public policy to regulate applications of AR in advertising.

Figure 1 depicts proposed relationships between the building blocks of the process of contextual advertising including: context mapping, content matching, and customer experience of spatial presence that integrate to drive media effectiveness (i.e., marketing metrics). Table 1 provides an overview of AR advertising configurations and their relationship with our theory-based building blocks.

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A research agenda for AR advertising

The theory-based process outlined in this paper offers an exploration of unique features of AR that enable contextualisation of advertising. In Figure 1, we illustrate a conceptual framework that describes a research paradigm for contextual AR advertising. Our framework and organises conceptual building blocks which can stimulate research in this domain. The use of AR for advertising and its impact on customer engagement and behaviour is and will continue to be a complex phenomenon. This is why it seems pertinent for advertising scholars to widen our understanding, deepen the knowledge base and advance managerial insights by developing theory-driven models; and through research validate these by means of rigorous empirical explorations. The aim of this section is to provide guidance to future theorizing by offering a number of recommended research directions that align with the building blocks of contextual AR advertising paradigm.

Future research agenda for context mapping. Context mapping should be a significant topic of research in AR advertising. It is a unique aspect of the AR technology, which requires further advances in understanding of real-time marketing analytics, image

classification, and ultimately application of artificial intelligence (AI) in advertising. While text-mining techniques have been widely applied to online advertising research, contextual AR advertising requires a focus on image analysis. Researchers need to advance their techniques of image mining (Villarroel Ordenes et al. 2019). Moreover AR requires real-time analytics based on image classification to interpret contextual information on the fly. Researchers should broaden the definition of context mapping beyond the mere position of objects in the customer's physical surroundings. More broadly, context mapping involves *patterns of customer behaviour* that give meaning to objects in the environment. In this respect, image classification is situated yet current analytics overlook this point. Laboratory studies can aid the analytical work by investigating the situated interaction of customers with so-called environmental affordances. According to situated cognition theory, physical objects in a customer's surroundings predispose behaviour in predictable ways (i.e., they create contextual affordances) based on implied functions of these objects and the customer's tasks (Semin and Smith 2013). For example, a couch in a living room predisposes customers to sit down and linger, and this can influence how customers process brand information. Mathmann et al. (2017) showed that customers who sit (vs. move) during decision making are more likely to evaluate information in detail. Thus, research into context mapping could help managers interpret patterns of customer behaviour by following a customer's control of the visual perspective in AR. Because AR advertising 'sees with the customer's eye', context mapping needs to understand how patterns of gaze fixations link to customer's tasks and predict behaviour. Currently, managers might struggle to interpret AR gaze patterns. For example, some researchers proposed that returning the gaze back to an object may reflect accumulation of evidence and hence preference formation, whereas others argue the same patterns reflect customers' established preferences because people look at what they already like (Simmelmann and Weigelt 2018). Linking patterns of customer's visual perspective with

information about objects in the physical environment may allow improved classification based on situated *relevance* of objects during context mapping.

Future studies should also deploy experimental designs to empirically assess cause and effect relationships between pertinent affordance-behaviour relationships to gauge the impact of first-hand experience in lab as well as experimental field studies to uncover more complex patterns between customer behaviour and contextual information. In such designs it would be advisable to account for both observed heterogeneity and the impact of boundary conditions, such as visual or verbal information processing styles that customers may have (c.f., Hilken et al. 2017). Moreover, because AR provides significant opportunities for field experimentation, researchers will be able to assess the different ways in which context mapping can be extended in different situations to enable the full conversion funnel and gauge its impact on decision-comfort and confidence as well as actual choice behaviour.

As a result of growing sophistication of hardware (i.e., devices) and software, future research may not only focus on how customers interact with embedded virtual objects in their natural environment, but also on how they search digital offerings through object recognition. For instance, Shazam-like software applications of AR might provide customers with information on clothing or fashion accessories that other people wear. Relatedly, IKEA has recently included a visual search function in its app. Customers can point their smartphone camera at a piece of furniture, and IKEA's substitute or complementary products are immediately displayed. In terms of hardware, many of the current AR tools are based on simulating physical control through touch screen interactions (e.g., moving virtual sofas with the swipe of a finger). Next generation AR functionalities (e.g., Microsoft's HoloLens or Vuforia's Chalkboard) allow gesture recognition or voice activation, which may enable a higher degree of context mapping between physical interactions with an object through an

AR interface. Future work should monitor the impact of these technological advances on both the potential for expanding context analytics and the effectiveness of context mapping in AR.

Future research agenda for content matching. AR advertising provides expanded opportunities for research on creative content design. Currently we do not know the most effective combinations of information fit-to-task and visual appeal in creative execution. Heller et al. (2019b) showed how congruent multi-sensory information is integrated in AR. Yet, many aspects of sensory integration in AR remain to be investigated. For example, while it is expected that combinations of multi-sensory stimuli can drive attention focus (e.g., Toohey's Deer ad), the boundaries of sensory congruence (e.g., information that contrasts with the background context, or sensory modalities that provide different information) are not well understood in AR. Balancing content integration with attention capture is an important area of research in contextual AR advertising. Similarly, because AR relies on deep sensory integration within some but not all of the sensory modalities (e.g., visual and audio, but not taste or smell), applications like the KabaQ's AR restaurant app may need to investigate creative ways to integrate AR information across different sensory modalities like taste or smell; or to convey abstract information like healthy eating choices, for example.

Content matching research should also expand beyond visual integration in AR. To date many applications have attempted to closely replicate intuitive physics (Kubricht, Holyoak, and Lu 2017) that provide realistic embodied representation of AR objects embedded in the physical environment (Heller et al. 2016). For example, AR holograms typically do not pass through solid objects; they exhibit object permanence, and move in straight lines over short distances. Yet, there is anecdotal evidence that during the brief Pokémon AR craze (Kumparak 2017) some players would turn off AR graphics to improve performance in the game. Currently, we do not know to what extent close rendering of intuitive physics is necessary for efficient and effective interaction in AR, and if realistic

versus simplified forms of interaction (e.g., teleportation of AR holograms) could improve customer engagement.

The spectrum of potential in AR extends beyond information integration through embedding, yet little is known about the extent to which content matching can be enhanced by creative execution. Would customers accept more creative interpretations (like the Australia's Toohey's Dry advertisements that showed customer's tongue leave their mouth to grab a beer from the fridge) that in AR become significantly more real among their physical surroundings? Or would 'cartoon physics' (e.g., objects that hover briefly before falling to the ground) be more fun and engaging form of content matching in AR? Similarly, while in general we know that product evaluations can be influenced by information fit-to-task, there is a paucity of research on creative execution of reference point and contrast effects in AR advertising. Specifically, would a customer respond differently to AR advertising knowing that information is being adapted depending on the task and the point of comparison during AR interaction? The diagnosticity of different types of information formats and various visual execution styles in advertising could also vary across different product and service categories or across different stages in the purchase funnel (e.g., pre-sales vs. after-sales). More research is needed to investigate such boundary conditions of content matching.

Since the effects of creative execution may vary depending of the stage of decision making, there is further scope for testing the impact of contextual AR advertising along various steps in the customer journey (e.g., need recognition and awareness, evaluation of options, post-purchase word-of-mouth). Initial studies show that AR is generally perceived to be more informative (Yaoyuneyong et al. 2016). Future research is needed to identify which specific content and what AR modalities are most effective in different stages of the customer journey. Applications such as Yelp's 'Monocle' or social media platform 'Mirage' allow customers to tag physical locations with digital messages, animations and or ratings. In

addition to visual aspects, content matching is branching out by integrating related technologies. For instance, based on geo-location data, AR audio applications like Bose's "Frames" seamlessly merge real-world and digital (storytelling) audio. Customers who walk the famous Camino de Santiago trail in Spain, can hear the personal stories from other pilgrims—just as if they were walking alongside them (Adweek 2019). Future studies could focus on the effects of various types of localized and targeted modalities to improve content matching in combination with geo-tagging technology, while evaluating both the pros and cons of such approaches (Čaić et al. 2015).

Future research agenda for customer experience of contextualisation. While this manuscript followed an established view that marketers provide AR applications that allow customers to control content in a certain context (Scholz and Smith 2016), the topic of control of contextualisation can be approached from additional angles. Future research should also investigate how much control marketers should enable for contextual AR applications to ensure that customers engage in the desired interactions. While some AR applications require customers to follow exact steps when interacting with AR content (e.g. Burger King's "Burn that Ad"), others give customers more freedom in controlling AR content (e.g. IKEA Place). Future research should investigate whether this control is context dependent and which contexts require more (or less) control in the customers' hands (van Esch et al. 2016). Or, indeed, whether continuing advancements in technology will lead us to challenge the fundamental notion of control and whether this will be supplanted by notions of collaboration.

As with the introduction of many technological platforms, future research should examine how contextual AR advertising can be applied optimally in combination with related technologies. For instance, Virtual Reality (VR) that immerses the customer in fully digital environments can achieve similar objectives of promoting a brand or exposing a customer to

novel experiences. However, currently managers have not delineated advertising strategies for VR versus AR. For example, auto manufacturer Nissan recently launched its ‘See the Unseen’ AR campaign, which introduced its advanced vehicle safety technologies by means of Star Wars movie characters. The well-known characters showed new technological features to prospective car buyers that are not directly visible and hence not salient to customers. The campaign enjoyed wide popularity and outperformed other advertising campaigns across traditional and digital media in terms of brand awareness and favourability. In parallel, Nissan used their “Tech-drive” VR campaign where customers become immersed in a digital environment simulating the experience of using Nissan’s drive assistance technologies like the “Pro-Pilot”. Researchers can build on the notions of contextualisation to explore similarities and differences between AR and VR technologies in advertising. These technologies may share many of the context mapping and context matching principles, but they critically differ in the customer’s awareness of contextualisation. That is, the relation of the first-person awareness of contextual surroundings is different in AR versus VR. Researchers should explore how AR technologies focus the first-person awareness on digital information in the customer’s physical surroundings, versus VR technologies that move the customer’s first-person awareness into a fully digital context. Given the immersive nature of the AR and VR campaigns, both technologies could be linked through a narrative context based on a shared story-telling theme. For example, Nissan might relate their AR and VR campaigns using the star-wars characters, who would appear across the different reality experiences. Future research should embark on examining the creative role of AR-based advertising and its integration with VR within the transmedia story-telling and narrative persuasion as expanded notions of presence.

The research on expanding the notion of presence should also consider social aspects of AR (Hilken et al. 2020). Current understanding of spatial presence in AR is restricted to

aspects of the physical environment, which misses influence on the customer in physical settings. For example, Facebook has invested in AR and VR technologies (Costine 2017). As social AR technologies develop, AR advertising will inevitably integrate with social networks. Taking into account that purchase decisions are increasingly shared with friends and peers through social media apps, future research needs to assess how AR advertising can be designed to account for expanded notion of *social presence* to support shared-decision opportunities and perhaps co-creation. For instance, Akzo Nobel's 'Visualizer' app is not only a vehicle for displaying an extensive range of colour wall paints, it also enables customers to jointly decide on what colour to choose by exchanging visuals of colour designs. In parallel, research needs to be undertaken in collaborative B2B marketing as well. For instance, how can AR advertising bring together architects, designers, builders and end-customers in creating bathroom designs? As this extends the role of advertising into the new realm of shared decision making, guidance from future research is much needed. According to Feng and Mueller (2019), future research should moreover examine the effect of AR advertising across different cultures as an important moderator of optimal configurations of AR. That is, the AR affordances may have different perceived value when viewed through diverse cultural lenses.

Future research agenda for privacy protection. While the theory-based building blocks hold a promise for the future of contextual AR advertising and its applications offer relevant benefits to customers, AR may also produce significant security, transparency and privacy concerns as well as produce a range of ethical issues. There is a paucity of research that explicitly addresses these. As the technology is equipped to record data continuously and mix objects and information with observable reality, there are a number of unique concerns that may potentially conflict with customer interests and regulatory boundaries. A great deal of data that is registered by AR applications is not only personal data but, importantly, also

collected and contextualised in real-time. For instance, privacy concerns relate to the fact that a customer's identity is tagged (e.g., via facial recognition software) to geo-locations (e.g., personal environments) and ads that he or she is looking at in real time. Also, through recognition functionalities, AR offers the opportunity to record others and pervasively store sensory information without their knowledge. For example, facial recognition can seamlessly be coupled with private or social media-based information. This data could be accessed by many stakeholders, including application owners, advertisers, and market researchers. As such, future research is needed to understand how to provide strong privacy protections through encryption and anonymisation of data. Our framework identifies privacy protections as a crucial moderator of the ability of advertisers to contextualise AR content, and the effect of contextualisation on marketing metrics. Concerns over privacy protection have been discussed in relation to high profile failure of Google Glass to gain mainstream adoption for example (Haque 2015). Research is needed on how stakeholders can aim for 'privacy by design' in contextual AR advertising by incorporating privacy and security compliance from the ideation stages of campaigns. Insights are also needed to assess the extent to which privacy, transparency and security may act as adoption barriers to AR advertising by consumers, and/or what trade-offs they are willing to make for greatly enhanced interactivity, functionality and relevance.

In conclusion, AR is creating a host of exciting new avenues for advertising to enhance customer engagement and ultimately advertising effectiveness. In order to make sure that this potential becomes a reality we need to tread carefully and with insights augmented by robust and relevant research. We hope that this position paper will motivate and invite researchers to take a step in this direction.

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Figure 1: Conceptual framework

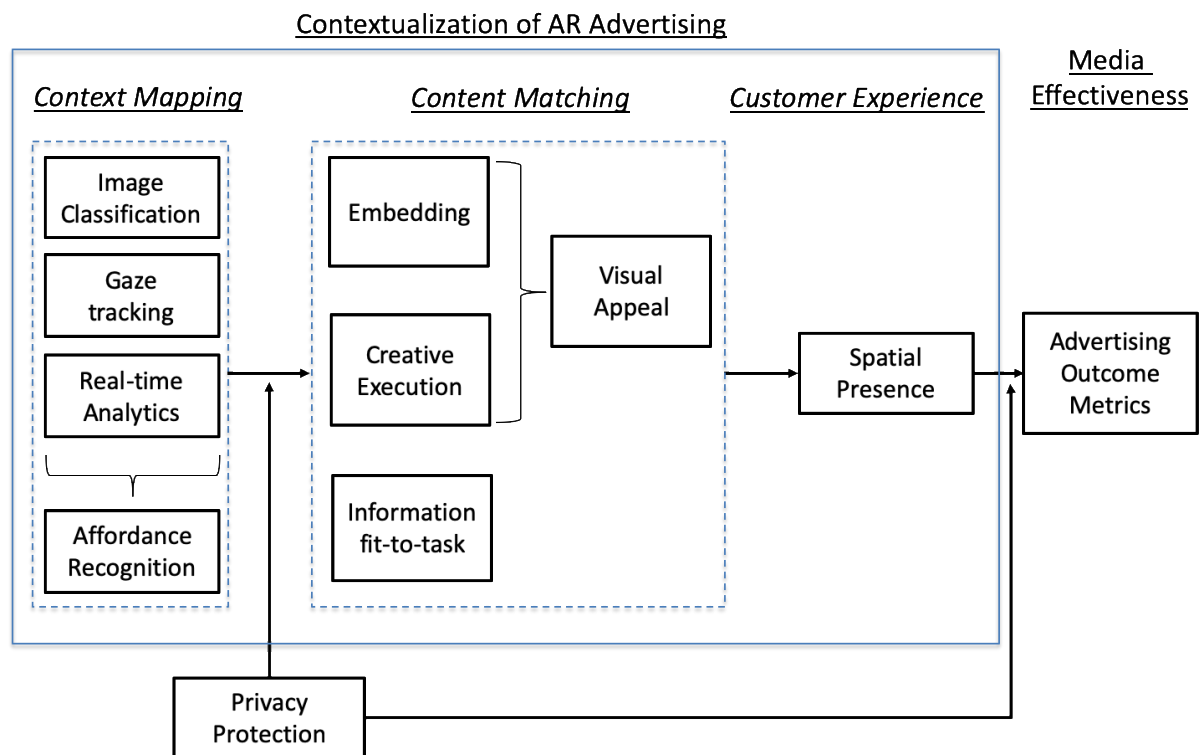


Table 1: Overview of different AR enabled advertising configurations

Modality/format of AR content	AR enabled advertising application examples	Context mapping					Content matching			
Established AR enabled advertising configurations		Real-time analytics	Image classification	Affordance recognition	Gaze tracking	<i>Directions for future research / development</i>	Embedding	Creative execution	Information fit-to-task	<i>Directions for future research / development</i>
Text	Yelp Monocle: Based on geo-location and using their smartphone camera, customers can inform themselves by seeing a restaurant's ratings and reviews virtually projected onto the physical location.	Low	Buildings	Low	Low	<i>Real-time analytics and gaze tracking to better judge customer interest and buying intentions?</i>	Text	Low	Factual	<i>Linking in multi-player mode to support spatial-presence and decision making?</i>
	Commonwealth Bank AR Property Guide: When looking at a property through their smartphone camera, potential buyers can view key information such the current price, sales history, price tendencies, and similar current listings.	Low	Houses	Low	Low		Text	Low	Factual	
	Google Translate AR: Pointing their smartphone camera at an advertising message or slogan translates the message or slogan into the customer's native language in real-time.	Real-time text recognition	Text recognition	Low	Low	<i>Affordance recognition to interpret text sentiment or meaning?</i>	Text	Low	Factual	<i>Creating meaning by linking translation to background information about the text?</i>
2D image	Akzo Nobel Visualizer: Using a smartphone or tablet, customers seeking to redecorate their homes can virtually change the colour of their walls, thus try out an entire palette of colours without picking up a paintbrush.	Low	Object boundaries	Low	Low	<i>Real-time analytics to provide wall colour recommendations and design?</i>	Wall colour	Low	Factual	<i>Information fit-to-task to consider contrast effects in colour selection?</i>
	Sephora Virtual Artist: Looking into the virtual mirror through the front-facing camera on their tablet or smartphone lets customers virtually try out—and purchase—the most recently promoted makeup styles (e.g., from their favorite social media celebrities).	Sales information	Body image	Low	Low	<i>Image recognition of customer's clothes to aid sales recommendations?</i>	Object to body	Low	Factual	<i>Supporting sales through product add-on recommendation to complete the look?</i>
3D image	Michael Kors AR Banner Ad: Clicking on a MK banner ad on Facebook lets customers (virtually) try on the newest pair of sunglasses and immediately make a purchase as part of the experience.	Sales information	Face image	Low	Low	<i>Real-time analytics to predict choice from sequence and length of try-ons?</i>	Object to body	Low	Factual	<i>Sequencing product try-on recommendations in line with reference point comparison?</i>

	KabaQ AR Menu: Enables restaurants to promote their (new) food menus by letting customers virtually sample the items on the menu.	Low	Object boundaries	Low	Low	<i>Affordance recognition to support healthy eating choices?</i>	Object to object	Low	Factual	<i>Linking experience of service in food preparation with the visualization of final product in AR?</i>
	IKEA Place: Customers can choose from the entire IKEA catalogue which products they would like to project into the physical environment through their smartphone camera, allowing them to completely (re-) design their homes with the swipe of their fingers.	Sales information	Object boundaries	Object identification	Low	<i>Multi-player gaze tracking for understanding social decision making?</i>	Object to object	Low	Factual	<i>Supporting the extended customer journey by linking evaluation, purchase, installation and use of products via AR.</i>
	Converse Shoe Sampler: Pushes the newest sneaker collections by enabling customers to virtually try on different colors and styles simply by pointing their smartphone at their feet.	Sales information	Body image	Low	Low		Object to body	Low	Factual	
Animation	Burger King AR: Prompts customers to virtually burn down competitors' ads to receive a coupon for a free whopper.	Low	Advertisements	Competitor ad identification	Low	<i>Geo-location mapping of competitor advertisements, and share of attention analysis?</i>	Animation	Virtual flames	Removing competitor information	<i>Effects of removing competitive information from the customer perspective?</i>
	NHS Blood Donation Campaign: Encourages actual blood donations with interactive AR outdoor ads where pedestrians can virtually donate blood and see a patient's health improve in real-time.	Low	Low	Low	Low	<i>Image classification and affordance recognition for recognition of emotional engagement?</i>	Animation	Virtual blood donation	Low	<i>Creative execution to support emotional engagement through symbolic AR imagery?</i>
	Augmented Repair: Promotes excellency in after-sales service by providing virtual instructions for self-service mapped onto the actual espresso machine.	Low	Low	Low	Low	<i>Real-time tracking of product failure?</i>	Animation	Low	Factual	<i>and customer service co-creation activities?</i>
Video	Pepsi Max AR Bus Shelter: Surprises commuters on New Oxford Street in London, where a bus shelter-size AR display augments the live street scene with, for example, a giant robot crashing, or a passer-by being abducted by aliens.	Low	Body image, buildings	Low	Low	<i>Back-end analytics of animations for extending customer engagement?</i>	Video and Animation	Action: robots, UFOs, explosions	Low	<i>AR advertising wear out, sensory overload, and need for variety?</i>

	Footlocker & Nike in-store AR: To promote the new LeBron basketball shoes, customers can scan a snap code, bringing a digital doppelganger of King James into the camera view, bursting from the advertisement and dunking on a virtual basketball net.	Low	Low	Low	Low	<i>Image classification to understand social interactions?</i>	Video	Low	Low	
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Table 1: (cont.): Emerging AR enabled advertising configurations

Shared points-of-view	Akzo Nobel Visualizer: Customers seeking to redecorate their home can share a photo or video of their living room to invite purchase advice from others. Within the shared visual, friends and family can experiment with color designs and convey their recommendation through AR.	Low	Object boundaries	Low	Low	<i>Real-time analytics to integrate data on social influences in decision making?</i>	Low	Low	Factual	Real-time social decision making through POV sharing?
Mixed reality	NY Times & BMW AR/VR Portals: In an augmented banner ad for BMW, customers can “walk” through a portal into a showroom with the new BMW X2 then turn around to see the real world behind them or enter a new portal for a virtual test drive.	Low	Low	Low	Low	<i>Linking analytics across AR and VR interactions?</i>	Animation	Mixing AR as portal to VR	Factual	Supporting product comparison by transporting the customer between multiple evaluation contexts mixed between AR and VR?
Visual search	Ikea Place: Customers can point their smartphone camera at a piece of furniture, and IKEA’s substitute or complementary products are immediately displayed.	Image search	Object boundaries	Object identification	Tracking gaze	<i>Real-time recommendations (e.g. matching colours with decor) and options for cross-selling?</i>	Object to body	Low	Factual	Effect on sales and competition of product replacement recommendations?
Gesture recognition and voice control	Microsoft HoloLens: Wearing only an AR headset, users can move virtual objects (e.g., furniture items) using natural hand gestures or voice commands, thus providing a more seamless interface experience.	Position, motion, voice, gaze	Embodiment	Low	Gaze recognition, voice recognition, motion tracking	<i>Linking multi-sensory information into predictive analytics?</i>	Multi-sensory integration	Potential	Potential	Boundaries of multi-sensory in/congruence, and intuitive physics in AR?
Audio AR	Bose Frames: Based on geo-location, real-world and digital (storytelling) audio are seamlessly merged. Consumers walking the famous Camino de Santiago trail in Spain can hear the personal stories from other pilgrims—just as if they were walking alongside them.	Low	Geo-locations	Low	Low	<i>Voice recognition and audio analytics?</i>	Audio integration	Storytelling	Factual	Location-based audio AR search?

